

## **EXHIBIT A.1 FUNDAMENTAL COMMISSIONING**

### **A. GENERAL**

The Commissioning process shall oversee and coordinate the traditionally separate functions of design review, equipment startup, system performance testing and balancing, control system calibration, construction and system documentation, and training.

The primary role of the CxA shall be to develop and coordinate the execution of a Commissioning Plan; observe and document the installation, checkout, start-up, and equipment and system testing to establish that equipment and systems are functioning in accordance with the requirements of the developing Contract Documents; and to assist the Owner, Using Agency, CM/GC and Project Manager in developing correct and complete documentation of the construction effort. The CxA will not be responsible for design concept, design criteria, compliance with codes, design, or general construction scheduling, cost estimating, construction management, or construction supervision. The CxA may assist the Design Team with design issues, problem solving, or the correction of construction non-conformance or deficiencies, but ultimate responsibility for meeting the project objectives and requirements resides with the Design Professional team and CM/GC.

### **B. SYSTEMS TO COMMISSION**

The specific systems that shall be commissioned include:  
As applicable to the project and noted herein

- Domestic Water Booster Pumps
- Domestic Water Heating Systems
- Chemical Water Treatment Systems
- Chillers
- Cooling Towers
- Condenser Water System
- Air Terminal Unit Systems, VAV, PIU, etc.
- Humidifiers
- Duct Silencers
- Dampers
- Variable Frequency Drives & Motors
- Air Distribution Systems
- Exhaust Air Systems
- Trend Logs
- Emergency Power System Verify testing is specified and such testing was completed.
- Generators Verify testing is specified and witness testing.
- Lighting Controls
- Daylight Dimming Controls
- Variable frequency and Speed Drives
- Grounding and Ground Fault Systems Verify testing is specified and such testing was completed.
- ATS auto transfer switches Verify testing is specified and witness.
- Add Building Envelope as a separate line item; Include with Cx through design review but include requirements for field inspections and testing in the Contract Documents. Is there a need for this?

## 1. DESIGN PHASE

The CxA shall complete the following tasks during the design phase:

- Review Owner's Project Requirements (OPR) for completeness and clarity.
- Review the BOD – Schematic Design
- Participate with owner to include Cx activities in project schedule.
- Prepare and distribute the initial Commissioning Plan.
- Attend initial meeting with and Design Team to discuss role of CxA and coordination of design.
- Provide Design Team members with Commissioning items to be considered during design.
- Perform a focused design review at the end of design development, and 80% CDs.
- Conduct a final back check before bid documents are issued to verify agreed comments are addressed.
- Prepare Commissioning specifications for the construction bid documents for all systems and equipment that are to be commissioned.
- Review CxA comments with Design team.

The Design Professional will provide adequate a written OPR, Basis of Design, and full sequences of operations, complete with points lists and control schematics for all equipment and systems for inclusion in the O&M manuals and for the CxA to use in writing functional tests.

## 2. CONSTRUCTION PHASE

- Conduct a kick off meeting with the Constructor Team to discuss Commissioning scope, plan, and schedule.
- Coordinate the Commissioning work with the Contractor. Ensure that Commissioning activities are being scheduled into the master schedule.
- Continue to update schedule and coordination throughout construction with Contractor and subcontractors.
- Submit final Commissioning Plan for construction with coordination and activities for Owner review. Review contractor submittals applicable to systems being commissioned for compliance with Commissioning needs. Verify that all submittals are approved by the Design Professional prior to being received on site.
- Prepare Pre-Functional Checklist to be used by the contractor as well as PFCs for the Commissioning Agent as a final verification.
- Review and approve normal contractor submittals applicable to systems being commissioned for compliance with Commissioning needs and forward on to GSFIC who will forward them on to the DP.
- Review RFIs and changes for impacts on Cx.
- The CxA shall provide a review of the contractor submittals to help identify any issues that might otherwise result in re-work and/or change orders.
- Review O&M information in developing PFCs and Functional Performance tests.

- Prepare Functional Performance Test procedures to contractor and Design Professional for comments on appropriate startup, operations, and systems safety. Procedures will include each function defined in the sequence of operations for the commissioned systems, including startup, shutdown, capacity modulation, emergency and failure modes, alarms and interlocks to other equipment.
- Coordinate with the contractor to witness startup of major equipment.
- Perform site inspection during rough-in of systems and equipment.
- Maintain an issues log of any items found to be a problem, poorly installed, or discrepancies.
- Attend periodic OAC on-site meetings for review of progress, coordination, and issues resolution.–In conjunction with these meetings conduct Commissioning Meetings as needed to report progress, address issues lists and coordinate activities,
- Witness a sample of any ductwork testing and cleaning procedures, sufficient to be confident that proper procedures were followed.
- Witness a sample of checkout, TAB, and calibration of controls.
- Review PFCs from Contractor for completion prior to completing Heery PFCs.
- Check the system graphics to assure all graphics are developed.

### 3. ACCEPTANCE PHASE

The CxA shall complete the following tasks during the acceptance phase:

- Continue to update schedule and coordination throughout construction with CM/GC and subcontractors.
- Coordinate & Supervise commissioning deficiency corrections.
- Maintain Record of functional testing.
- Obtain pre-functional reports from CM/GC with sign-offs that the systems have been checked out.
- Oversee TAB, to include verification and witnessing of 25% of TAB of all equipment, heat exchangers, air terminals, diffusers, grilles, hoods, terminal devices, and equipment testing, and document findings.
- Perform/Witness functional testing of each major piece of equipment to demonstrate that each item of equipment and system is operating according to the Design Intent and contract documents. Functional testing shall include operating the system and components through each of the written sequences of operation. Test on respective HVAC equipment shall be executed during both heating and cooling seasons.
- Provide troubleshooting to assist in resolving control problems, as they are uncovered. Functional testing shall be performed on all control points.
- Check the system graphics to assure all graphics are developed. Check a 10% sample of point's mapped graphics to assure they are correct.
- Maintain a deficiency log of any items found to be a problem, poorly installed, or discrepancies. Provide the log and test results to the Owner, CM/GC, Using Agency and Project Manager with recommended actions.
- Coordinate retesting as necessary. One retest will be provided as part of normal checkout. More than one retest will be considered work outside the normal scope of work.

- Notify the Owner and CM/GC of the unacceptable findings if 10% of identical pieces of equipment fail to perform to the requirements of the contract documents because of manufacturing defects which do not allow it to meet the submitted performance spec, request an explanation of the problem and proposed solution from the CM/GC; and then review the proposed solutions.
- Attend weekly meetings while on-site for functional testing.
- Attend on-site meetings for review of progress, coordination, and issues resolution.
- Review O&M documentation for completeness. This review shall be in parallel with the Design Professional team's review of the O&M documentation for conformance to the project specification.
- Provide the Using Agency staff with a systems training on "how the building is supposed to operate."
- Review, pre-approve training agenda provided by Contractor for the operating personnel by the CM/GC.
- Review equipment warranties
- Perform seasonal testing checkout of equipment at maximum cooling and maximum heating.
- Prepare the Commissioning Final Report. The report shall include an executive summary, list of participants and roles, brief building description, and the following sections:
  - a. Owner's Project Requirements
  - b. Basis of design
  - c. Pre-functional checklists complete
  - d. Functional checklists complete
  - e. TAB reports
  - f. System schematics
  - g. Control strategies and set points
  - h. Deficiency Log

#### 4. ACCEPTANCE PHASE

The CxA shall complete the following tasks during the warranty phase:

- Review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal Commissioning.
- Interview facility staff and identify problems or concerns they have with operating the building as originally intended.
- Identify deficiencies that may come under warranty or under the original construction contract.
- Prepare a detailed evaluation after ten months on the status of warranty issues for the Using Agency and Owner.
- Attend on-site meetings to discuss warranty issues.